IJARSCT

ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

Impact Factor: 5.731

Volume 11, Issue 1, November 2021

Review Paper on Successive Doses of Gamma Irradiation and EMS for Inducing Mutation in *Glycine max* and *Brassica juncea.*

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Abstract: Suitable dose of mutagen in mutational breeding play a key role in developing a new mutant. Every plant's seed have different number of chromosome, time duration of S phase, and morphology of seed like size of seed, seed coat and biochemical composition of seed. On the basis of these characters different type of seeds require different wavelength of gamma rays and different concentration of EMS for inducing mutation in mutational breeding. The present work on successive dose of Gamma irradiation and EMS for *Glycine max* (Soybean) and *Brassica juncea* (Indian mustard) helps to select correct doses of mutagen for the suitable crop.

Keywords: Mutagenesis, Gamma irradiation, EMS, Mutation breeding

I. Introduction

Glycine max (Soybean) and *Brassica juncea* (Indian mustard) both crops are major oilseed crops of India. Soybean and Indian mustard both have dozens of varieties and some wild varieties, from these varieties some are best in oil yield, some are best in productivity but some varieties have poor character. With the help of mutation breeding we can upgrade that poor characters of worst varieties in safest way.

II. Review

Glycine max

(P. Gopinath, et al. 2015) worked on Soybean (Glycine max (L.) Merr.) Var. Co-1 seeds were treated with physical mutagen namely such as gamma rays and chemical mutagen namely such as Ethyl Methane Sulphonate (EMS) and Diethyl Sulphate (DES). Various concentrations of gamma rays 10, 20, 30, 40, 50 and 60 KR, EMS (0.1, 0.2, 0.3, 0.4, 0.5 and 0.6 %) and DES (0.1, 0.2, 0.3, 0.4, 0.5 and 0.6 %). The yield parameters like plant height, number of cluster per plant, number of seeds per plant and seed yield per plant were recorded the moderated and high mean value in the 50 KR of gamma rays 0.5% of EMS and 0.4% of DES treated population with compared to control plants. *(Nandanwar, R.S., Manjayya, J.G. 2008)* The experiment was conducted to develop such a cultivar that yield well in favorable season and suffer with minimum yield losses during water stress. The seed material of two promising cultivars viz.JS-93-05 and JS-71-05 was send to BARC, Trombay, Mumbai (India) for irradiation with different doses of gamma rays viz.150 Gy, 250 Gy and 300 Gy. *(Zhu Baoge, Gu Aiqiu et al.2003)* The seeds were irradiated with doses of 0 (control), 100, 200, 300, 400 and 500 Gy gamma radiation. The highest crude oil yield was obtained at 300 Gy and and content of 35.09 %. *(Yeşim Kara et.al. 2016). (R. kartika and Subba Lakshmi 2006)* A study was undertaken on induced mutagenesis with COl and co2 varieties of soybean. The mutagens studied were gamma rays (20, 30, 40, 50 and 60 kR) and EMS (5, 10, 15, 20 and 25 mM).). In an assessment to fix the LD, value, the varieties responded differently. A subtle difference was observed between the varieties COl and CO2 in the degree of tolerance to the mutagens, viz., COl, (62 kR gamma rays, 264 mM EMS) and C02 (58.3 kR gamma rays and 25.7 mM EMS). It is concluded that COl tolerate higher doses of gamma rays and EMS. In general, the treated population had manifested a reduced expression than the untreated population in all the

biometrical traits. The mutagen gamma ray manifested higher percentage of reduction than EMS. In M, EMS induced higher proportion of chlorophyll mutants than gamma rays. Among viable mutants, sterile mutant occurred more predominantly followed by stunted growth in both the varieties due to the effect of mutation. *(Archana Patil et.al.2007)* About 3 kg seeds of soybean cultivar MACS 450 were used for mutagenic treatments. Mutagen Treatments: Seeds of soybean cultivar MACS 450 were treated with ethyl methane sulfonate (EMS) and c-radiation in varying concentrations. Treatments (150 g, approximately 1,000 seeds per treatment) consisted of 4 different doses of c-radiation (100, 150, 200 and 250 Gy), 3 different concentrations of EMS (0.05, 0.10 and 0.15%). (Mudassir Hafiz Khan et al. 2013) irradiated seeds of Bragg, Hodgson and Lee-74 containing 1113% moisture content with 100 to 500 Gy gamma rays and 5 to 30 Gy fast neutrons and reported that growth inhibition increased with increasing doses and germination was inhibited only at the higher doses. Lee-74 was the most sensitive variety to gamma radiation and Bragg the most sensitive to fast neutron doses above 20 Gy, as revealed by differences in epicotyl length.

Brassica juncea.

(M.A. Malek et.al 2012) Four thousand and eight hundred seeds (1200 seeds for each of four doses) of the popular mustard variety, BARIsarisha-11 were irradiated with four different doses of gamma rays (600, 700, 800 and 900 Gy) from 60Co gamma cell in 2004 to induce new genetic variability for the selection of improved mutant genotypes. The treated seeds were sown to obtain the M1 generation along with parental control. The M2 seeds from 2341 individual M1 plants (745, 632, 508 and 456 plants from 600, 700, 800 and 900 Gy, respectively). *(P. J. Ninawe et.al. 2018)* In the present investigation the effect of gamma rays on seed germination and seedling growth of two genotypes of mustard (B. juncea) was analysed. The seeds of two genotypes viz. Bio-902 (Pusa jaikisan) and SNM-217 were irradiated with gamma rays at different doses 800Gy, 1000Gy and 1200Gy.Sensitivity of gamma irradiation was observed on seed germination and growth parameters such as seed germination rate (%), seedling height (shoot length and root length) and seedling vigour (vigour index). Our findings confirmed that, with the increase of doses of gamma irradiation there was gradual decrease in the seed germination and seedling growth. This indicates the effectiveness of gamma rays on the germination rate, seedling height and seedling vigour. It was found that germination rate was minimum at 1200 Gy as compare to control and other doses in Bio-902 and SNM-217 (76.66% and 92.00%) respectively. Seedling vigour index was found to be a minimum in 1200 Gy as compare to control and other doses in both genotypes 1245.72 and 1498.68 respectively. *(Prashant Yadav et.al. 2016)* Ethyl methanesulfonate (EMS) was used as chemical mutagen for induction of mutation. The study was conducted under controlled conditions in laboratory with three replications. Hundred seeds of each genotype for each replication were first presoaked in distilled water for 2 h and then treated overnight with 8 different concentrations of EMS (0.1%, 0.25%,0.5%, 0.75%, 1.0%, 1.25%, 1.5% and 2%) for 12 h at 24 ºC with constant shaking at 100 rpm. The percent germination was reduced from 91, 98 and 99 to 2, 7 and 5 percent with 1% of EMS for genotypes RH-749, NRCHB-101 and S. Alba, respectively. At the same time, almost all the genotypes showed zero (0.00%) germination at the concentration of 1.25% and higher doses of EMS. This revealed that the doses of EMS higher than 1% are highly lethal irrespective of genotype and species. *(Ahmed Chamim et al. 2021)* The seeds of Brassica were irradiated with various doses of y-ray (900, 1000, 1100 and 1200 Gy) and a combination treatment with ethyl methane sulfonate (1000 Gy + 2% EMS). The control seeds were not exposed to either radiation or EMS. The results revealed that doses of y-radiation altered all the studied traits for both the tested varieties. Increasing doses of y-radiation were responsible for decreasing the seed germination, plant survival, plant height, number of siliqua plant-1, seed siliqua-1, dry weight of whole plant, SPAD value, weight of dry husk plant-1, leaf area and photosynthetic rate. *(Mahla, S. V. S. et.al 1990)* Seeds of Brassica juncea genotypes RCU101 and Domo 4, and their F1 hybrid, were treated separately with 0.5, 0.75 and 1.0% ethyl methanesulfonate (EMS) and 80, 100 and 120 kR γ-rays. Yields and siliqua characters were measured in the M1 and M2. Mutagenic treatments, particularly EMS, enhanced yields in some populations, but mean values of siliqua length and seeds/siliqua were decreased on the whole.

III. CONCLUSION

The present work shows that the frequently used suitable dose of Gamma irradiation for *Glycine max* in between 50 Gy to 300 Gy. And best results obtained at 100 to 200 Gy. And EMS doses are 0.05 to 1 % is used but the successive dose are 0.2 to 0.5 % Shows desired mutant character, shows $LD_{50.}$ Successive combine dose of EMS and Gamma irradiation is 50 Gy + 0.2 %, 100 Gy + 0.2 %, 50 Gy + 0.4 %, and 100 Gy + 0.4% shows desired mutation. *Brassica juncea:* Most Frequently used suitable dose of Gamma irradiation in between 500 Gy to 1250 Gy. And best results obtained at 650 to 900 Gy. And EMS doses are 0.2 to 2.5 % is used but the successive dose are 0.5 to 0.8 % Shows desired mutant character, shows $LD_{50.}$ Successive combine dose of EMS and Gamma irradiation is 700 Gy + 0.5 %, 750 Gy + 0.6 %, 800 Gy + 0.5 %, and 800 Gy + 0.6% shows desired mutation with LD_{50}.

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